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SECTION OF GEOLOGY AND MINERALOGY[1]

MAY 3, 1943

LIEUTENANT COLONEL GERALD FITZGERALD, Chief, Aeronautical Chart Service, American Air Force: *Reconnaissance Mapping by Photogrammetric Methods.*[2] (This lecture was illustrated by lantern slides.)

Military operations in wartime have always affected the development of mapping techniques. It is natural, therefore, that from the time of Col. Laussedat (1849) military scientists of many countries have studied the application of photography to mapping. The Balloon Corps of the U. S. Army considered the application of aerial photographs to mapping as early as 1861 and Lt. Col. Reber of the Signal Corps actually compiled a topographic map from aerial photographs during the Spanish American War. He described a radial line method of compilation in a manual issued in 1896.

Prior to World War I the principal advance in photogrammetry in the Western Hemisphere was pioneered by DeVille in Canada, the U. S. Geological Survey and U. S. Coast and Geodetic Survey in the United States with emphasis on terrestrial photography. In 1911 the National Research Council sponsored the development of a multiple lens camera. J. W. Bagley and F. H. Moffet of the Geological Survey perfected plans

[1]The Section of Anthropology met May 24, 1943. Doctor Ronald Lippitt delivered a paper entitled, "The Training of Participant Observers." No abstract was received.
[2]Manuscript of paper presented was approved for publication by Public Relations Bureau, War Department, on April 29, 1943.

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for this camera and in 1918 completed actual construction of a camera and transforming printer.

From 1920 to 1940 tremendous strides were made by government agencies and commercial operators in the development of methods and equipment. Foreign equipment was modified and improved, adapted to quantity production of large scale topographic maps. During this period the emphasis was unfortunately on large scale, detailed maps and the national mapping program was almost completely lost sight of.

In the present war, the high speed of mechanized units and the great areas covered in actual operations make small scale tactical maps more important. Our total mapping efforts still fail to meet all military requirements. Equipment and trained personnel are still engaged in mapping areas within the continental United States while hundreds of thousands of square miles in actual or potential combat areas remain unmapped.

Despite the tendency to ignore the use of photogrammetry for reconnaissance mapping, some development has been accomplished. The RCAF, in 1921, inaugurated a three-oblique camera program, plotting with the aid of grids. This method gives reasonable accuracy at reconnaissance scales in regions of moderate relief. The Survey of India has used high obliques extensively and in this country O. M. Miller has, with the single eyepiece plotter, mapped large areas in northern Labrador. In 1932, the photoalidade was designed by R. M. Wilson. This simple and comparatively inexpensive instrument has produced satisfactory reconnaissance maps.

Months before Pearl Harbor, the Army Air Force attempted development of a method which would insure rapid compilation of small scale charts over large unmapped areas. In February 1941, the Geological Survey undertook to aid the Air Forces in the development of a suitable method. The Alaskan Branch of the Survey had worked for years on reconnaissance mapping methods and at the time was using the Wilson photoalidade. Besides the personnel of the Alaskan Branch, many others in the Survey participated in developing the tri-metrogon method, under the sponsorship of Col. Minton W. Kaye, American Air Force.

The tri-metrogon system had only one objective, photogrammetrical compilation of aeronautical charts with all possible speed. Specifications called for photography at 20,000 ft., the flights separated about 20 miles. Military aviation accomplished this photography; the work

Field
New York Acad. of Sciences
9-21-23

of compiling agencies began with delivery of the prints. With a production line for charts as the goal, technique must be simple, and equipment portable and procurable under priority requirements.

The unique feature of the tri-metrogon method is horizon to horizon coverage, by means of three K-17 cameras fitted with wide angle lenses. The compilation units perform a number of operations in sequence, and the personnel is trained to perform single operations in groups. The operations include indexing, identification of geodetic control and picture points, tilt analysis, radial plotting and graphic delineation of horizontal directions to picture points. Existing geodetic control is used wherever possible, and astronomic positions are obtained with the prismatic astrolabe in other cases.

Succeeding steps include combining the radial plot of vertical pictures with paper templates made from the obliques, and the construction and joining of the slotted metal templates from many pictures to form a network of control for planimetry, which is delineated on the photographs by using stereoscopes. The planimetry is transferred from picture to manuscript with two new instruments, vertical and oblique sketchmasters. These are adaptations of the camera lucida for which credit is due Mr. J. L. Buckmaster.

A final proofreading against the photographs precedes photographic reduction to compilation scale and the inking preparatory to reproduction. Contours are added where necessary by use of the photoalidade.

The application of high obliques to the study of geological structure and geography are strikingly apparent on many of the pictures taken for charting purposes. Not the least of these applications will be the correlation of information on pictures. The results of glacial and tectonic actions as well as structural control of drainage appear at first glance.

Accuracy has proved to be adequate for pilotage use on a scale of 1:1,000,000 and detail more than adequate for 1:500,000. The average cost of planimetric compilation with tri-metrogon photographs has ranged from 5 to 50 cents per square mile. The addition of 500 or 1000 feet form lines averages approximately 20 cents per square mile in addition. These figures include total outlays for research and equipment to date but exclude the cost of obtaining photography and control.

Present military operations will undoubtedly result in many startling developments in methods and equipment.

SECTION OF BIOLOGY

MAY 10, 1943

DOCTOR A. E. MIRSKY AND PROFESSOR A. W. POLLISTER, Hospital of the Rockefeller Institute, New York, N. Y., and Department of Zoology, Columbia University, New York, N. Y.: *Studies on the Chemistry of Chromatin.* (This lecture was illustrated by lantern slides.)

Fifty years ago the chemistry of chromatin was an active field of investigation. It is a curious paradox that as the biologist's interest in chromatin grew, the biochemist paid less and less attention to this material (see Mirsky, 1943, for literature). With the development of genetics and especially of cytogenetics more and more remarkable properties were attributed to chromatin, and yet at the same time chemical investigation of chromatin languished. The great work of Miescher and Kossel on the chemistry of chromatin had considerable influence on protein chemistry and also on the chemistry of nucleic acids, but investigators in both of these fields were not greatly concerned, as Miescher perhaps even more than Kossel had been, with chromatin itself. In the long run, however, there could be little doubt that the theory of the gene would bring a revival of interest in the chemistry of chromatin, and signs of this revival have now been apparent for some time. There is, for example, Caspersson's work on the ultraviolet spectrophotometry of chromatin and there are the investigations of Stadler and of Hollaender on the wave-length dependence of the mutations produced by ultraviolet light. Investigations along these lines emphasize the need for a more direct study of the chemistry of chromatin. In this paper we present a brief summary of some of our work in this field.[1]

Miescher and Kossel used strong acids and bases to extract nucleic acid and the basic proteins (histones and protamines). Although it was with these preparations that the foundations of our knowledge of chromatin were laid, it is apparent that all of the substances prepared by Miescher and Kossel are breakdown products of the materials that exist in the nucleus. Obviously much less drastic methods of extraction are needed. We have found that neutral salt solutions suffice to extract nucleoproteins from the nuclei of many animal and plant cells. This method of extraction has a two-fold advantage over the procedure of Miescher and Kossel: (1) The extracted materials are less altered by the

[1]The cytological part of these investigations has been aided by a grant from The Rockefeller Foundation.

reagents used; (2) It is possible to extract nuclear constituents from a far wider range of animal and plant cells.

(1) In the older procedure the basic protein was split off and extracted with hydrochloric or sulfuric acid, and the nucleic acid was subsequently extracted with alkali. With salt solutions the whole nucleoprotein complex is extracted. In Miescher's classical work on salmon sperm it was always inferred that protamine and nucleic acid exist in combination within the sperm cell, but a nucleoprotamine was never extracted as such. By means of salt solutions it is now possible to extract a nucleoprotamine complex from sperm. Strong acid and base, used by earlier workers, not only separated nucleic acid and protein from each other but also undoubtedly degraded the separated components. The nucleoproteins extracted by salt solutions, by contrast, are evidently highly polymerized; for they form strikingly fibrous precipitates, and when dissolved, are exceedingly viscous and exhibit birefringence of flow. Under the action of strong acid and alkali these properties are lost, as the large complexes are depolymerized.

(2) Most of the work of Miescher and Kossel was on fish sperm. A few other kinds of cells were used, but Kossel believed that histones are present in certain special cells only. An entirely different conclusion has been reached by extracting nucleohistones with salt solutions. Nucleohistones have been prepared from so many different animal cells, from plant cells, and even from bacterial cells, that it seems likely that they are universal nuclear constituents. It therefore becomes possible to consider nucleohistones to constitute a part of the germinal material, which the general applicability of the principles of genetics indicates must be essentially the same substance in all cells.

In referring to the older preparations of nuclear materials mention should be made of the works of Lilienfeld, Huiskamp, and Bang as well as that of Miescher and Kossel. By extraction with water the former investigators were able to obtain a nucleohistone from the thymus gland. This method has an exceedingly narrow range of applicability, being limited mainly to the thymus; but by means of it highly polymerized nucleic acid was prepared many years ago. We find that the nucleohistone prepared by extraction with water differs from that extracted by salt solutions. In absence of salt, or at very low concentrations of salt, some depolymerization occurs, and this is not reversed by dissolving the material in concentrated salt solutions.

The numerous nucleohistones (and nucleoprotamines) that we have

prepared resemble each other in that they all contain desoxyribose nucleic acids and basic proteins. A question that immediately arises concerns the extent to which the desoxyribose nucleic acids and basic proteins prepared from different sources resemble each other. Concerning the nucleic acids it is important to know whether their content of purine and pyrimidine bases varies. According to the tetranucleotide theory of Levene a nucleic acid contains equal quantities of four different nitrogenous bases; but it should be noted that the methods of estimating the different bases are inexact and that such analyses as have been made on desoxyribose nucleic acids were on materials derived from only a few different sources. It would be unwarranted to suppose that the composition of all desoxyribose nucleic acids is the same. And yet a definite restriction can be placed on possible variations among all the nucleic acids which we have examined. A careful study of the Dische diphenylamine reaction shows that it can be used to measure the ratio of purine to pyrimidine nucleosides in a desoxyribose nucleic acid. We find that in every preparation we have examined the ratio of purine to pyrimidine nucleosides is 1:1; they all conform to the tetranucleotide theory.

Histones prepared from different sources resemble each other, as Kossel was the first to observe, in being precipitated by addition of ammonium hydroxide and in failing to dissolve in an excess of this reagent. This is an indication that histones have basic isoelectric points. We find that another point of resemblance among histones can be detected in their ultraviolet absorption spectra. Almost every protein has an absorption band in the ultraviolet with a maximum at 2800 A. U. In collaboration with Dr. George Lavin we have determined the ultraviolet absorption spectra of a number of histones from the nucleohistone complexes that have been isolated by salt extraction. Every histone so far examined has a band in the same region as other proteins, but the maximum is slightly displaced, being at 2750 A. U.[1] A further uniformity, of a negative nature, has been discovered in the composition of the different histones. We find that in no histone that we have isolated is there more than a trace of tryptophane. Since most proteins

[1] Caspersson has investigated the ultraviolet absorption spectrum of thymus histone and believes that the maximum of absorption lies at approximately 2850 A. U., and on this basis, in an extensive series of investigations, he has drawn far-reaching conclusions concerning the protein content of chromatin in many different cells. The position of maximum absorption which he has assigned to histone is far different from that which we find; and if our observations are correct, Caspersson's conclusions become untenable. In comparing our observations with Caspersson's it should be noted that his histone preparations contained so much nucleic acid that the absorption spectrum of histone could not be perceived directly from the optical observations, and it was accordingly necessary to subtract the absorption due to nucleic acid from the over-all absorption to determine the absorption due to histone. Our histone preparations are sufficiently pure so that no such calculations are needed; the position of the absorption band of histone follows directly from the optical observations.

contain this amino acid, its absence in histones is of value in defining this group of proteins, and it also serves as a criterion of purity in their preparation.

The source of these nucleoproteins is the cell nucleus. This is clearly indicated, first, by the chemical analysis (see Mirsky, 1943). Desoxyribose nucleic acid is a component of all cell nuclei, as shown by positive Feulgen nucleal reaction. (When there is any nucleic acid in the cytoplasm—for example, in the pancreas cell—the sugar is always ribose.) Furthermore, protamine and histone are types of protein known only from cell nuclei.

Cytological studies confirm the chemical analysis; for they show conclusively that the nucleoprotein isolated by strong saline extraction is derived from the cell nuclei (Mirsky and Pollister, 1942, 1943). Direct observations of the nucleus (liver cells and spermatozoa) show that it swells and goes into solution upon treatment with strong sodium chloride solutions. Furthermore, as one would expect, the yield of nucleoprotein from tissues is directly proportional to nuclear volume, inversely proportional to the amount of cytoplasm. The highest yields are from suspensions of spermatozoa; thymus, kidney, and liver give successively lower yields. Finally, from carp eggs (a huge cell with but a single nucleus) the yield is not great enough for a visible precipitate.[1] Using a modification of Stoneberg's citric acid method (Stoneberg, 1939) we have isolated nuclei from mammalian thymus and liver. The yields of nucleoprotein from these nuclei are very high, comparable with those from sperm suspensions in being nearly 90 per cent of the dry weight.

Thus chemical analysis and cytological observations agree in showing that the cell nucleus is the source of the desoxyribose nucleoproteins. Furthermore, the source must be the nuclear chromatin; for chromatin only is Feulgen positive; and the sperm nucleus, one of the best sources of nucleoprotein, is nearly solid chromatin, lacking the other usual nuclear constituents, the nucleolus and the nonstaining fluid (nuclear sap) between the chromatin strands.

There can be no doubt that chromatin contains nucleohistone (or nucleoprotamine). The significance which we attribute to this fact will depend to a considerable extent on how much of these nucleoproteins are found in chromatin. Miescher concluded from his work

[1] Professor R. R. Bensley tells us that from the nonnucleated red blood-corpuscles of mammals he has found it impossible to obtain any fibrous nucleoprotein by salt extraction. It is most interesting that, by contrast, we find that the nucleated red blood-cells of fishes and birds are among the most excellent sources of fibrous desoxyribose nucleoprotein.

on salmon sperm that approximately 90 per cent of the sperm head consists of protamine and nucleic acid. This conclusion was arrived at by determining the phosphorus and nitrogen contents of the sperm head and then analyzing isolated samples of nucleic acid and protamine for phosphorus and nitrogen. By comparing these figures it was possible to calculate what part of the nitrogen and phosphorus of the sperm head could be constituents of nucleic acid and protamine. Given his analytical results, Miescher's conclusion is plausible, though it would be far more convincing if it had been possible actually to isolate 90 per cent of the sperm head as nucleoprotamine. All of the nucleoprotamine present in the sperm head can be extracted by means of neutral salt solutions, and it can, indeed, be demonstrated that approximately 90 per cent of the sperm head does consist of nucleoprotamine.

Fish sperm presents certain advantages for the study of chromatin: a major part of this cell consists of chromatin, and large quantities of sperm are often available. A still more favorable material would be chromatin itself, isolated from other constituents of the cell. We have found that it is possible to isolate chromatin threads from a number of different cells. The method is simple; and large quantities of material can be prepared without great difficulty.

Our first success in preparation of chromatin threads came while we were working with a material from which the threads can be isolated with such ease that we had the good fortune to obtain them entirely by chance. If the erythrocytes of the salmon or carp (the latter is the most readily available large live fish in New York) are thoroughly washed with saline, much of their hemoglobin leaks out. These cells, suspended in saline, are readily broken in a high-speed mixer (such as the Waring Blendor) and on centrifuging one obtains a slightly colored, clear supernatant and a colorless sediment. Under the microscope the latter can be seen to consist almost entirely of a mass of delicate threads.[1] These are chromatin threads; which give a strong positive Feulgen reaction, and stain with other typical nuclear dyes, e.g. acetocarmine. Chicken erythrocytes, a more generally available material than fish erythrocytes, are another satisfactory source from which to isolate chromatin threads. The great advantage of the nucleated erythrocyte is that practically

[1]There is always a small amount of contaminating material that stains with acid dye (light green). This is nonnuclear material. Microscopic study of the material at various stages in the procedure shows the light green staining material to be of two sorts, fragments of red blood-cell membranes and of the cytoplasm of leucocytes.

all of its cytoplasm is soluble in saline, but by modifying the procedure somewhat we have also prepared these threads from liver and thymus.[2]

Many of these threads may, actually, be the individual chromosomes of the resting nucleus. More significant, from the standpoint of analysis, is the fact that the threads are uniformly staining masses of chromatin with no indications of interchromatin fluid or of nucleoli, the presence of both of which complicates a quantitative analysis of entire, intact nuclei. The chromatin threads may, for analytical purposes, be regarded as masses of pure chromatin; and the only nonchromatin material in a preparation of these threads consists of the fragments of cell membranes and cytoplasm mentioned above. Since these fragments are not dissolved by strong saline, they form the residue after extraction.

When chromatin threads are extracted with 1.0 M.NaCl all of their substance passes into solution—a process that can be followed with the microscope. The material in solution is exceedingly viscous and precipitates in fibrous form when, by adding to six volumes of water, the salt concentration is reduced. This fibrous material is a nucleohistone. If the nucleohistone from a known quantity of chromatin threads is treated with alcohol and ether and then dried it is found to be equivalent to 93 per cent of the weight of the material (chromatin threads + cytoplasmic fragments) from which it was prepared. The same yield of nucleohistone is obtained from chromatin prepared from fish erythrocytes, chicken erythrocytes, or calf thymus. Our yield of 93 per cent is certainly a low estimate for the nucleoprotein content of chromatin, for the chromatin threads cannot be considered to be free, by any means, of other cell components. The cytoplasmic fragments, which do not dissolve in 1.0 M.NaCl, appear to be sufficient to account for the remaining 7 per cent of the dry weight—so that, in fact, the chromatin threads are nearly 100 per cent nucleoprotein. There can be no more than traces of other material.

Thus far we have referred to these fibrous nucleoproteins as nucleohistone (or nucleoprotamine) because there can be no doubt that they contain both nucleic acid and a basic protein like that which Kossel first prepared from nucleated erythrocytes, and which he called histone. It is logical to inquire next whether in addition to histone there is any other kind of protein in these nucleoproteins. To answer this involves

[2]Chromatin threads have also been isolated, independently of us, by Claude and Potter, from lymphocytes. In a paper that will soon appear their method of isolation will be compared with ours.

some difficulty, because when histone is split from the complex by addition of hydrochloric acid much protein still remains attached to nucleic acid. Is this residual protein of the histone type? The same question arises concerning nucleoprotamine because from this material, too, only a part of the protein is liberated by addition of hydrochloric acid. In this latter case there is the following good evidence that the residual protein is of the protamine type. A significant characteristic of protamine is its lack of tyrosine. The Millon reaction is a sensitive and specific test for this amino acid, and when this test is applied to the material that remains after protamine is split by hydrochloric acid from a nucleoprotamine, no tryosine can be detected. The residual protein is therefore lacking in tyrosine and, to this extent, it may be considered to be of the protamine type. By analogy it may be supposed that the residual protein in a nucleohistone is of the histone type. The absence of tryptophane in histones makes it possible to provide more direct evidence. By means of the Hopkins-Cole reaction exceedingly small quantities of tryptophane can be detected, but not in the presence of nucleic acid. It is possible to separate nearly all the protein from a nucleohistone by shaking a solution of this material with a mixture of chloroform and octyl alcohol (a method originally due to Sevag). The separated protein is rendered insoluble by this procedure, but it can be examined for tryptophane, and no more than traces are detectable. After prolonged shaking only a very small amount of protein remains attached to the nucleic acid. It can therefore be said that insofar as absence of tryptophane is a characteristic of histones, practically all of the protein in a nucleohistone is of the histone type.

We have considered the possibility that some nonhistone protein is loosely attached to chromatin and is removed when chromatin threads are prepared. To find this protein, if indeed there is any such, we have split off protein from chromatin while it is still within the nucleus by adding hydrochloric acid to isolated nuclei (of the thymus gland). Separated protein was found to contain less than 0.05 per cent of tryptophane, so that it may be concluded, again, that very little, if any, nonhistone protein is present.

A final goal in an analysis of chromatin is, of course, the determination of the chemical nature of those most important functional constituents of chromatin, the genes. Our analyses indicate that chromatin, with which we associate the special functions of gene reproduction and gene action, is largely, if not entirely, composed of a unique substance,

nucleohistone. Is the gene, then, nucleohistone? It is difficult to avoid the conclusion that the specialized functions of chromatin are properties of its specialized component, nucleohistone—a line of reasoning analogous to one by which it has always been assumed that the function of muscular contractility is intimately dependent upon the presence, in abundance, of the unique muscle protein, myosin.

The bond between histone and nucleic acid in a nucleohistone is firm enough to cause them to migrate as one component in an electric field and to remain together in a film when spread at an interface. And yet there is evidence that desoxyribose nucleoproteins dissociate to some extent even without addition of strong acid, alkali or concentrated salt solutions (saturated sodium chloride). The dissociation of nucleoprotamine can be demonstrated by placing it in a cellophane tube and dialyzing against a salt solution sufficiently concentrated (1 molar) to keep the nucleoprotamine in solution. It is found that protamine slowly diffuses through the membrane, leaving the large particles of nucleic acid within the membrane. The tendency of nucleohistone to dissociate when dissolved in 1.0 M.NaCl cannot be demonstrated so simply because the molecules of histone are too large to pass through a cellophane membrane. That there is an equilibrium between histone and nucleic acid when nucleohistone is dissolved in 1.0 M.NaCl can be demonstrated by adding an excess of protamine to the solution. The protamine competes with histone for nucleic acid and by precipitating the nucleoprotamine formed, the displaced histone can be separated from the other components present. Protamine added in excess can also displace histone from fibers of nucleohistone precipitated in physiological saline, indicating that even under more physiological conditions nucleohistone tends to dissociate. Histone can also be displaced from nucleic acid when protamine is added to chromatin threads and even when it is added to intact, isolated, nuclei.

These observations on the displacement of histone by protamine provide us with a much needed method of preparing histone without the use of hydrochloric acid. But surely of far greater significance is the demonstration that in chromatin there is a tendency for nucleohistone to dissociate. From the massive, indiffusible particles of nucleohistone small quantities of histone (a protein of relatively small size) are apparently constantly dissociating. If this process occurs in the living cell, and we have good reason to believe it may, it could play an important

part in the mechanism of gene action, for it would mean that a protein component of the chromatin is diffusing out to other parts of the cell.

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SECTION OF PSYCHOLOGY

MAY 17, 1943

MR. DAVID SHAKOW, Worcester State Hospital, Worcester, Massachusetts: *Some Aspects of the Problem of Unsuccessful Personality Screening.* (This report is based on material supplied by Dr. and Mrs. William Malamud.)

The results of a preliminary analysis of the social psychiatric data obtained on a group of 49 mentally disordered soldiers who have broken down in military service are reported. This group was taken from a larger one of 110 patients studied from various angles: physiological, endocrinological, psychological, clinical psychiatric, and social-dynamic. The patients were divided into six groups: four types of schizophrenia, psychoneurosis and psychopathic personality. The schizophrenic classification was not according to conventional subtypes but rather according to preinduction status.

The trends revealed are as follows:

1. From the point of view of screening, two of the schizophrenic groups and the psychopathic personality group appear to consist largely of persons who could be relatively easily screened out at induction were some social background data made available. The other three groups (two schizophrenic groups and the psychoneurosis group) could not so be screened out. In the latter case, if it seems desirable to keep persons who fall into these categories out of the armed forces (the question of the desirability of selective occupation and mental hygiene in the army should be considered, however) then more searching technics of a psychiatric, psychological and perhaps physiological nature will have to be developed.

2. From the point of view of the background characteristics, the first three groups give evidence of poorer adjustment in most spheres, i.e., there is a greater frequency of family neuropsychiatric abnormality, disturbed home conditions and unsocialized personality development.

3. In the military situation, whereas the conditions which seem to play a prominent role in causing breakdown in the psychoneurotic and the two less disturbed schizophrenic groups are either socially oriented or the result of concrete difficulties, in the other three groups these factors seem to be mainly the result of inadequacies of a deep personal nature.

SECTION OF PHYSICS AND CHEMISTRY

MAY 8, 1943

Conference on *"Magneto Chemistry."*

The Section of Physics and Chemistry held a Conference on "Magneto Chemistry," as the third in the series for the Academic Year of 1942–1943. Doctor Leonor Michaelis, The Rockefeller Institute for Medical Research, New York, N. Y., was the Conference Chairman in charge of the meeting.

The program consisted of the following papers:

"The Interpretation of the Temperature Variation of the Paramagnetic Susceptibility," by J. H. van Vleck, Harvard University.

"The Magnetic Properties of Hemoglobin and its Derivatives," by Charles D. Coryell, California Institute of Technology.

"The Magnetic State of Semiquinones and Their Polymers in the Crystalline State," by Leonor Michaelis.

"Magneto-optic Rotation Effects in Solutions," by Charles E. Waring, Samuel Steingiser, and Herbert Hyman, Brooklyn Polytechnic Institute.

NEW MEMBERS

ELECTED MAY 18, 1943

ACTIVE MEMBERS

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Anson, M. L., Ph.D., Biochemistry, Director of Biochemical Research, Continental Foods, Inc., Hoboken, N. J.

Barnes, Marion David, Ph.D., Physical Chemistry, Instructor in Chemistry, Columbia University, New York, N. Y.

Cowles, Philip B., Ph.D., Bacteriology and Immunology, Associate Professor of Immunology, Yale University School of Medicine, New Haven, Conn.

Eberhardt, Jacob M., Geology, Mineralogy, U. S. Office of Censorship, New York, N. Y.

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Singher, H. O., Ph.D., Biochemistry, Enzyme Chemist, Memorial Hospital, New York, N. Y.

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Newell, John M., D.Sc., Immunochemistry, Senior Chemist, Massachusetts Antitoxin and Vaccine Lab., Boston, Mass.